

**Indian Maritime University**  
**(A Central University, Govt of India)**  
**End Semester Examinations – December 2023**  
**Programme Name: B. Tech (Marine Engineering)**  
**Semester: IV**  
**Subject Code: UG11T3405**  
**Subject Name: FLUID MECHANICS I**

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Date: 28.11.2023

Max Marks: 70

Duration: 03 Hrs

Pass Marks: 35

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General Instructions

- (i) All Sections (A, B & C) are to be attempted.
- (ii) Options, if any, are specified in respective section.

**Section A**

Ten MCQs/Fill in the Blanks of 01 Mark each – Choose the correct answer as applicable.

1. The viscosity of liquids \_\_\_\_\_ with increase in the temperature
  - (a) increases
  - (b) decreases
  - (c) first increases than decreases
  - (d) first decreases than increases
2. The point of application of the force of buoyancy on the body is known as
  - (a) Center of gravity
  - (b) Center of buoyancy
  - (c) Metacentre
  - (d) None of the above
3. For a Newtonian fluid
  - (a) Shear stress is proportional to shear strain
  - (b) Rate of shear stress is proportional to shear strain
  - (c) Shear stress is proportional to rate of shear strain

- (d) Rate of shear stress is proportional to rate of shear strain
4. The continuity equation is connected with
- (a) viscous fluids
  - (b) compressibility of fluids
  - (c) conservation of mass
  - (d) steady/unsteady flow
5. Energy loss in a pipe line is due to
- (a) Surface roughness
  - (b) Friction offered by pipe wall as well as by viscous function
  - (c) Viscous action
  - (d) All of the above
6. Viscous forces are not present in
- (a) rotational flow
  - (b) irrotational flow
  - (c) laminar flow
  - (d) none of the above
7. Which of the following is example of free vortex flow?
- (a) A whirlpool in a river
  - (b) Flow of liquid through a hole provided at the bottom of container
  - (c) Flow of liquid around a circular bend in a pipe
  - (d) All of the above
8. In a static fluid
- (a) resistance to shear stress is small
  - (b) fluid pressure is zero
  - (c) linear deformation is small
  - (d) only normal stresses can exist
9. In a steady, ideal flow of an incompressible fluid, total energy at any point of the fluid is always constant. This theorem is known as
- (a) Euler's theorem
  - (b) Navier-Stokes theorem

- (c) Reynold's theorem
  - (d) Bernoulli's theorem
10. The pressure measured above the atmospheric pressure is termed as
- (a) Line pressure
  - (b) Gauge pressure
  - (c) Vacuum pressure
  - (d) None of the above

### **Section B**

Five Questions of 02 Marks each

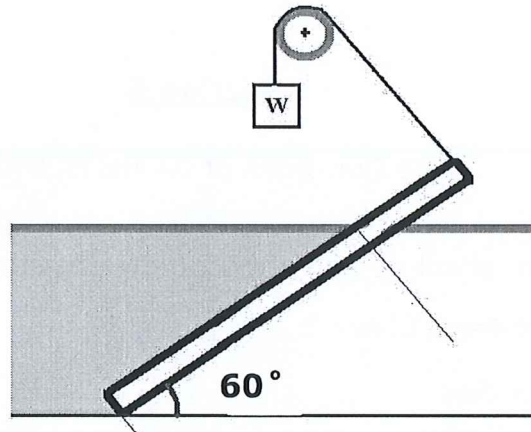
- 11. Define gauge, absolute and atmospheric pressure?
- 12. Explain about Pascal law?
- 13. Define Vortex flow
- 14. What is fluid flow? What are the different types of fluid flows?
- 15. What are the different energy losses in pipes?

### **Section C**

Seven Questions of 10 Marks each of which any 05 questions to be answered.

- 16. a) A hydraulic press has a ram of 20 cm diameter and a plunger of 3 cm diameter. It is used for lifting a weight of 30 KN. Find the force required at the plunger? (5 marks)
- b) What is a manometer? Explain its construction and work with a simple diagram. (5 marks)
- 17. a) A circular plate of diameter 1.2 m placed vertically in water in such a way that the centre of the plate is 2.5 m below the free surface of water. Determine: (i) Total pressure on the plate. (ii) Position of centre of pressure (5 marks)
- b) Find the condition for maximum power transmission of power and corresponding efficiency of transmission. (5 marks)

18. Derive the expression for the loss of head due to sudden expansion in pipe line.
19. A rectangular gate 5m x 2m is hinged at its base and inclined at  $60^\circ$  to the horizontal as shown in figure. To keep the gate in a stable position, a counter weight  $W$  of 49050 N is attached at the upper end of the gate. Find the depth of water at which the gate begins to fall. Neglect the weight of the gate and friction at the hinge and pulley.



20. a) Derive the expression for the force exerted by a jet on the stationary inclined flat plate. (5 marks)
- b) A nozzle of 50 mm diameter delivers a stream of water at 20 m/s perpendicular to a plate that moves away from the jet at 5 m/s. Find the force on plate and the efficiency of jet. (5 marks)
21. a) The diameters of a pipe at sections 1 and 2 are 20 cm and 30 cm respectively. If the velocity of water flowing through a pipe at section 1 is 5m/s, then find the discharge through the pipe. Also, determine the velocity in section 2. (5 marks)
- b) A jet of water, 75 mm in diameter, issues with a velocity of 30 m/s and impinges on a stationary flat plate which destroys its forward motion. Find the force exerted by the jet on the plate and work done. (5 marks)
22. Derive the expression for Bernoulli's equation from first principles